the land to project very considerably between the two points. On further examination, I found that, instead of making the land trend inward to a very deep bay at Sapapali'i and Iva, as it does in reality, it had been made to extend seaward in a series of headlands. This error is perpetuated in all the maps I have seen, including Grundemann's, and that published in the *Journal des Museum Godeffroy*, both of which are based on Wilkes's chart.

My third and last example shall be one of a different kind. In 1870 I visited an island north of Samoa known as Quiros or Gente Hermosa. Wilkes' expedition described it as being *without a lagoon*. I found it to be barely four miles in diameter, but with a *deep fresh-water lagoon in its centre about three miles in diameter*. Now as the ring of land around this lagoon is only about one-third of a mile across, I cannot imagine how any members of the expedition could have landed without seeing the water. Such an inaccuracy as this would have been bad enough in the description of an ordinary traveller. It is inexcusable in an expedition specially fitted out for scientific observation.

S. J. WHITMEE

Cook's Collections

In NATURE, vol. xix. p. 373, a remark of Dr. Hamy, of Paris, is reproduced, concerning "the fate of Cook's collections in being buried in an Austrian museum." It will be of general interest to make known that, what there is in Vienna of ethnographical objects in relation to Cook, consists of 260 numbers, chiefly originating from Cook's third voyage. These objects were bought by order of the Emperor Franz in the year 1806, at the auction of the Parkinson Museum in London (previously Lever Museum), and now form part of the large ethnographical collections, which will be accessible to the public in a few years in the new, nearly completed, Imperial Natural History Museum of Vienna. This museum will become one of the greatest and most complete on the continent, uniting all mineralogical, geological, palæontological, prehistoric, anthropological, ethnographical, zoological, and botanical imperial collections of Vienna under the charge of Prof. Hochstetter.

A. B. MEYER

Royal Zoological Museum, Dresden, February 28

Magnetic Storm, May 14, 1878

THERE appears to have been a slight error in my note (vol. xix. p. 148); in the sixth line, it should read 14th instead of 15th.

With this exception the observations are correctly reported, and the period during which the greatest trouble was experienced in working on the Persian Gulf cable covers the time at which the magnetic storm was observed at Stonyhurst to be at its height (vol. xviii. p. 617).

I cannot quite agree with Mr. Preece when he suggests (vol. xix. p. 173) the advisability of recording earth-currents in Webers. Comparatively few of the readers of NATURE would appreciate the magnitude of an earth-current if expressed in those terms, while every one, I think, will understand me when I say that the earth-current passing through the line equalled that which would be produced by a certain number of cells connected to the same circuit.

The systematic observation of earth-currents in different parts of the world is no doubt very desirable, but to be of value it must be regulated and collated by some central authority. I feel convinced that if the Society of Telegraph Engineers invited assistance in this matter, and pointed out what was actually required, the appeal would be very readily responded to.

Kurrachee, February 6 HENRY C. MANCE

Intellect in Brutes

IF Mr. Henslow will read my letter again he will find it distinctly stated that the "several occasions" on which the leakage took place were referred to in connection with the agency of rats only. The plumber informs me that in none of the cases (four or five) was there any sign of injury to the pipe by frost. In the specimen which I have, the rats have made two *ineffectual* attempts to perforate the lead, and have succeeded in two distinct places. Had a frost crack existed, with consequent escape of water, there would have been no necessity to make two fruitless attacks on the pipe elsewhere. The specimen may be seen by any one interested at the office of *The Country*, 170, Strand. Metaphysicians will probably think that Mr. Henslow has stumbled into a quagmire in his discussion of "practical" and "abstract" reasoning. Does he believe that brutes and boys in common have nothing but the faculty of "practical" reason? When a boy finds the value of x in a simple equation, is he not dealing with "abstract" ideas?

ARTHUR NICOLS

I AM not opposed to Dr. Darwin's teachings, nor do I care much whether science proves that man is descended from Adam or from some extra clever race of monkeys, so long as the *truth* is established. In regard to the explanation given at p. 365 of the rats eating the pipe to get at the water because they "heard the water trickling," I am inclined to look at the matter in a simple matter-of-fact way, and so feel inclined to think they cut the pipe because it was somehow in their way. Lead and block-tin gas-pipes are found cut in a similar way. Now, are they cut to get at the *gas?* Lead waste-pipes are also often found so cut, both from the outside and inside. I happen to be a practical plumber myself, and have had to deal with rats in many ways, but I scarcely think that "the reasoning power of the rat" in this case has been properly reasoned out.

21, Renfrew Street, Glasgow, March 1 W. P. BUCHAN

I BELIEVE "that the reasoning faculty in man and animals differs in degree only." But I do not think Mr. Nicols' plumber's lead-pipe case (NATURE, vol. xix. p. 365) a well-tested instance of rat sagacity. We have not sufficient proof that the rats gnawed the pipe for the purpose of getting at the water; though, of course, they used the water after having come upon it. It seems more likely that they gnawed the pipe because it obstructed their tunnelling operations; else why did they cut it in two separate places? Mr. Nicols says "a rat will not drink foul water." Neither will I when I can get better, but I am afraid I should need to put up with the foul if I lived in a sewer.

Cambuslang HENRY MUIRHEAD

It is somewhat difficult to understand Mr. Henslow's remarks on the above subject in NATURE, vol. xix. p. 385. He tells us that if the dog that rang the bell to fetch the servant to let him out of a room in which he was shut up, *had not been taught to ring the bell*, "it would have been *abstract reasoning*, but it was only practical." Further on he says that brutes never acquire "abstract reasoning."

The Arctic fox, by Mr. Henslow's own showing, appears to have used "abstract reasoning," because it had never been taught to cut the line attaching the bait to the trigger of the gun before taking the bait (of which I have seen several cases), or to dig a trench in the snow to avoid the shot. Can Mr. Henslow be a sportsman? If so, he ought to know that in the case referred to, to pull the bait downwards *out of the line of fire* was the only safe way for the fox to have acted, so as to get his head out of danger. Had he used what Mr. Henslow calls "abstract reasoning"—which, I presume, means pulling the bait, not the line, to *one side* out of the line of fire, the fox would certainly have been shot, as the bait could not have been moved more than four or five inches from the wooden stake through which the bait-line passes.

If Mr. Henslow really means that the fox should have shown his powers of "abstract reasoning" by going up to the line of fire between the gun and the bait, and then pulled the string until the gun went off, I think the chances of reynard's ever eating the bait would be very small indeed. I have known him do what showed equal or greater intelligence, namely, cut the bait-string, as already mentioned.

JOHN RAE

Royal Institution, February 28

MR. HENSLOW, in his letter on this subject, complains that "brute reasoning is always *practical*, but never *abstract*." As an instance of what appears to me abstract reasoning in a dog, I beg to offer the following: A few years ago we had in our possession a terrier gifted with a propensity (probably instructive) for worrying the sheep that were put to graze in a field separated from our house by another field. Coming out of the house one day I observed this dog crossing the latter field, evidently intent upon a little amusement. I called him back, he obeyed; but when he came to a patch of brushwood which hid him from view, he cut straight across the field, under cover of the brushwood, to behind a hedge, and then pursued his course

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towards the sheep field. What taught him that he could thus reach his game unobserved? A. J. A.

HERE is an instance of "instinct" which shows, I think, that there is no difference whatever between the reason of animals and that of men.

A mare here had her first foal when she was ten or twelve years old. She was blind of one eye. The result was that she frequently trod upon the foal, or knocked it over when it happened to be on the blind side of her, in consequence of which the foal died when it was three or four weeks old. The next year she had another foal; and we fully expected that the result would be the same. But no; from the day it was born she never moved in the stall without looking round to see where the foal was, and she never trod upon it or injured it in any way. You see that reason did not teach her that she was killing her first foal; her care for the second was the result of memory, imagination, and thought, after the foal was dead and before the next one was born. The only difference that I can see between the reasoning powers of men and of animals, is that the latter is applied only to the very limited sphere of providing for their bodily wants, whereas that of men embraces a vast amount of other objects besides this.

The above limitation does not, I think, apply strictly to domestic animals, dogs especially, which seem to acquire some perceptions beyond mere animal ones.

Hull, February 28 C. W. STRICKLAND

Parhelia

ALLOW me to record the occurrence of parhelia here this morning. The phenomenon lasted about twenty minutes, and was fairly brilliant. No halo was apparent, merely a mock sun on either side of the true one, and the line passing through the three, dipped towards the south at an inclination of 2° to 3° to the horizon. E. W. PRINGLE

Uxbridge, March 4

Unscientific Art

AS a specimen of Unscientific Art, let me bring to the notice of your readers a two-page engraving in the last number of the *Illustrated London News*, entitled "Capture of Sirayo's Stronghold."

If there is any truth in the laws of perspective the Zulus flying before the cavalry are indeed "sons of Anak."

Scientific Club, March 2 E. W. PRINGLE

Bees' Stings

IN NATURE, vol. xix. p. 385, a correspondent asks whether the identity of bee-poison with formic acid has yet been determined. Some sixteen years ago I made a few experiments with the poison from wasp-stings, and found, to my astonishment, that it was invariably alkaline instead of acid. A living wasp, duly held in the cavity of a perforated cork, was easily induced to sting a piece of turmeric paper; a brown-red spot immediately appeared. A. H. CHURCH

Cirencester, March 1

A NEW PROCESS IN METALLURGY[1]

LONG before human art acquired the knowledge of metal-making, prehistoric man had learned to make fire of the dry stems and branches of trees; in the charred fragments of half-burnt wood we recognise a form of carbon, the first simple elementary body produced by man from the complex natural bodies with which he was surrounded. In the knowledge of the use of fire, then, was the first dawn of art, particularly of that art which deals with the reduction of simple bodies from compound minerals. To convert metallic compounds into metallic elements is the domain of the metallurgist, and the means by which this is effected constitute the basis of metallurgic art. Carbon was thus a necessity to metallurgy—with the knowledge of fire the world emerged from the stone age. From those early times down to the present day, no fusion has been effected without using carbon, which in the form of wood, coal, or charcoal, has been the substance invariably used by the metallurgist for the production of heat, and to enable him to decompose and to smelt metal-bearing materials.

The new process, however, we are about to describe, has for its object the smelting of metalliferous substances without the employment of carbonaceous fuel. The sulphides of iron, lead, and zinc are known to be combustible substances of almost universal occurrence, and when burnt under favourable conditions give rise to a great evolution of heat. We have calculated the relative temperatures thus produced, from which it appears that the temperature at which iron pyrites (bisulphide of iron) burns in air under the conditions most favourable to the development of a high temperature is over 2,000° C., protosulphide of iron burning at about 2,225° C. Zinc sulphide, or blende, gives a temperature of 1,992° C., and galena 1,863° C.; while calculations made in a similar manner with coal, assuming it to be completely burnt, show the temperature attainable to be 2,787° C. These mineral sulphides, which are therefore natural and almost inexhaustible sources of heat and energy, can under certain circumstances be burnt more economically than their heat-giving equivalent of coal.

The best means, however, of utilising this heat-producing property of metallic sulphides is not so apparent as would appear at first sight. Only iron pyrites is sufficiently combustible at a low temperature to burn in the open air, the mass being raised to the temperature at which the oxidation takes place solely by the union of the sulphur and iron with aerial oxygen. In Spain this is carried on in vast heaps of hundreds of thousands of tons, and the operation extends over many months. The oxide of iron that remains is typical of those mineral substances which, once burned in the primeval operations of nature, gave up their stores of heat and force, and became, as it were, inert bodies.

Going back now to the combustion of carbon, it is well known that it burns at widely varying temperatures, as, for example, in our bodies, in a common coal fire, or in a powerful furnace. A great deal of attention and thought has been spent upon the subject of the economy of carbonaceous fuel, and great advances have been made in this direction, yet the expenditure of coal or coke necessary, say, to melt a given quantity of metal, still far exceeds the theoretical limit. The main causes of this discrepancy may be accounted for as follows:—(1) That only a fractional part of the oxygen of the air passed into the furnace acts upon the material to be burnt. (2) That the oxygen is not brought in contact with the combustible matter with sufficient rapidity to attain the necessary temperature for the operation. (3) That gases pass off hot and unburnt; these are now, however, frequently utilised.

There is one metallurgical operation in which the first two sources of loss are perfectly avoided—namely, by blowing air through molten crude iron, as in the Bessemer operation, where, by the burning of small quantities of carbon and silicon contained in the crude iron a very high temperature is attained, which is not the case in the process of puddling, where the oxidation is spread over a considerable period of time, although the same constituents are frequently burnt in similar proportions. But even in the Bessemer process the carbon is only half burned, and a large amount of heat escapes with the carbonic oxide and nitrogen. When, however, we blow thin streams of air through molten sulphide of iron lying upon a tuyère hearth, a high temperature is produced by the perfect combustion which ensues in the midst of the sulphides, and no unburnt gases excepting sulphur vapour escape from the surface of the molten mass. Hot nitrogen and sulphurous acid being the only gaseous products

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[1] A paper with full details of the process was read by John Hollway at the Society of Arts on February 12, 1879; Prof. H. E. Roscoe, F.R.S., in the chair.

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